

ART. XIV.—A Contribution to the Study of the Rotifera of New Zealand.

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Plates VIII.—XI.

TAIERI Beach is a small settlement on the south bank of the Taieri River, just at its mouth. There are a great number of small algæ-covered pools scattered over the district, but I found Rotifers in only four of these. One small pool of about 3 ft. by 4 ft. and 18 in. deep supplied thirteen out of the sixteen species to be mentioned in the course of this paper, while the next pool to it—about 200 yards away—was perfectly barren. Most of the varieties were found to be restricted in their distribution, each occurring in only one pool. The only species that was found to be distributed over a number of pools is that which is already noted for its cosmopolitan distribution—I mean *Rotifer macrurus*. A small Salpinidæan was also widely distributed. There were also several eccentricities in the time as well as the place of the Rotifers' appearances. A variety that would be most common at one time would totally disappear for weeks, and then would suddenly reappear in as great profusion as before. These points have, of course, been observed by every writer on Rotifers. Most of the species were lacustrine, but one was found in the water of a tidal creek, where the water was salt enough to be a habitation of marine Gasteropods, and to deposit quite large crystals of salt when it was evaporated.

The following are the only pools examined with any results, with the species found in them, the Roman numerals standing for the number of each species as described in this paper:—

1. A small pool: I., III., IV., VI., VII., VIII., IX., X., XI., XII., XIII., XIV., XV.

2. A horse-trough: II., V., IX., I.

3. Ditch in connection with tidal creek (saline): IX., XVI., I.

Thus sixteen species are described in this paper. Of these, four are found in Britain. The other twelve are new, and include representatives of two new genera.

The system of classification followed is that proposed by Ehrenberg and Dujardin, modified by Hudson and Gosse. This divides the class into the four orders—*Rhizota*, *Bdelloida*, *Ploima*, and *Scirtopoda*. Two Rhizotes have already been

described from New Zealand (*vide* Trans. N.Z. Inst., vol. xii., p. 301, and vol. xxv., p. 193), and my specimens include representatives of the *Ploima* and *Bdelloida*, so that only *Scirtopoda* remain to be discovered. This system of classification will be found fully described in Hudson and Gosse's "Rotifera," as well as (in its crude form) in the Journal M. Sci., xxiv., 335.

The following is Hudson's latest classification, reduced to tabular form:—

| Order. | Characteristics. | Family. | Characteristics. |
|--------------------------|--|---------------|---|
| Rhizota .. | Fixed when adult. Foot wrinkled, non-retractile, non-furcate, and with a sucking-disc | Floscularidæ | Corona produced longitudinally into setigerous lobes; buccal orifice central; ciliary wreath a single half-circle above the buccal orifice. Trophi uncinatæ. |
| | | Melicertidæ | Corona no setigerous lobes; buccal orifice lateral; ciliary wreath a marginal continuous curve, bent, and encircling corona twice; only one gap. Trophi malleoramate. |
| Bdelloida | Swim with ciliary wreath, and creep like a leech. Foot wholly retractile within the body, telescopic, furcate | Philloidinidæ | Corona two transverse circular lobes; ciliary wreath marginal continuous curve encircling corona twice; two gaps. Trophi ramate. |
| | | Adinetadæ | Corona flat prone surface; ciliary wreath, furred ventral surface of corona. Trophi ramate; frontal column soldered to dorsal surface, and ending in two hooks. |
| Ploima .. | Swimming with their ciliary wreath, and in some cases creeping with toes | Micrococidæ | Corona obliquely transverse, flat, circular; buccal orifice central; ciliary wreath a marginal continuous curve, and two curves of larger cilia one on each side of buccal orifice. Trophi forcipate. Foot stylate. |
| Sub-order Il-loricata | Integument flexible; no stiffened shell. Foot absent, furcate (usually), not wrinkled; feebly telescopic, and partially retractile | Asplanchnidæ | Corona subconical, with one or two apices; ciliary wreath single, edging corona; intestine and cloaca absent. |
| | | Synchætadæ | Corona a transverse spheroidal segment, sometimes much flattened, with styliigerous prominences; ciliary wreath a continuous or interrupted marginal curve encircling corona; mastax very large, pear-shaped. Trophi forcipate. Foot minute, furcate. |

| Order. | Characteristics. | Family. | Characteristics. |
|---|---|--------------|--|
| Sub-order Il-loricata — <i>contd.</i> | .. | Triarthradæ | Body furnished with skipping appendages; corona transverse; ciliary wreath single, marginal. Foot absent. |
| | | Hydatinadæ | Corona truncate, with styligerous prominences; ciliary wreath two parallel curves, one fringing corona, the other within it, prominences between the two. Trophi malleate. Foot furcate. |
| | | Notommata-dæ | Corona obliquely transverse; ciliary wreath of interrupted curves and clusters, usually with a marginal wreath surrounding the buccal orifice. Trophi forcipate. Foot furcate. |
| Sub-order Loricata | Integument stiffened into a wholly or partially enclosing shell. Foot various | Rattulidæ | Body cylindrical or fusiform, smooth, without plicæ or angles; contained in a lorica closed all round, but open at each end. Trophi long, asymmetric. Eye single, cervical. |
| | | Dinocharidæ | Lorica entire, vase-shaped or depressed, sometimes faceted, often spinous; head distinct, with chitinous covering. Foot and toes often greatly developed. Trophi symmetrical. |
| | | Salpinidæ | Body more or less completely enclosed in a firm lorica, which is open at each or only one end, and divided down the back by a fissure, whose sides are united by membrane. Two furcate toes always exposed. |
| | | Euchlanidæ | Lorica of two dissimilar plates, one dorsal and ventral, united so as to form two confluent cavities, of which the upper is much the larger. Foot jointed, furcate. |
| | | Cathypnadæ | Body enclosed in a lorica, open at each end, of two plates, the dorsal more or less elevated, the ventral nearly flat, the two divided by a deep lateral longitudinal sulcus, covered with flexible membrane. Toes two or one, always exposed. |

| Order. | Characteristics. | Family. | Characteristics. |
|----------------------------------|------------------|-------------|---|
| Sub-order Loricata —contd. | .. | Coluridæ .. | Body enclosed in a lorica usually of firm consistence, variously compressed or depressed, open at both ends, closed dorsally, usually open ventrally. Head with chitinous hood. Toes two, rarely one, always exposed. |
| | | Pterodinadæ | Lorica entire, various; corona and wreath those of <i>Philodinidæ</i> . Trophi malleo-ramate. Foot wholly retractile, transversely wrinkled, jointless, toeless, ending in a ciliated cup, or foot absent. |
| | | Brachionidæ | Lorica box-like, open at each end, generally armed with anterior and posterior spines. Foot long, excessively flexible, wholly retractile, wrinkled, and two-toed. |
| | | Anuræadæ | Lorica box-like, broadly open in front, behind open by only a narrow slit; usually armed with setæ. Foot wholly wanting. |
| Scirtopoda | .. | Pedalionidæ | Arthropodous limbs six; corona of two concave lobes; ciliary wreaths as in <i>Philodinidæ</i> . Trophi malleo-ramate. |

The different types of trophi are referred to under the names given to them by Hudson. He presumes the typical form of mastax to be that found in *Brachionus urceolaris* (Journal Mic. Sci., xxiv., 350). There are two hammer-like bodies (mallei) (*c*, *d*), which work on a split anvil (incus) (*e*, *f*). Each malleus consists of an upper part, or head (uncus) (*d*), and a lower part, or handle (manubrium) (*c*). The incus also consists of two parts, the upper divided into two symmetrical halves (rami) (*e*), which are supported on a lower piece (fulcrum) (*f*). There the mallei are prominent, but all the other types of trophi are marked by successive degradations of the mallei and increase of the incus. The following are the seven chief types of trophi:—

1. *Malleate*.—Mallei stout; manubria and unci of equal length; unci 5- to 7-toothed; fulcrum short. (*Brachionus*.)

2. *Sub-malleate*.—Mallei slender; manubria about twice as long as unci; unci 3- to 5-toothed. (*Euchlanis*.)

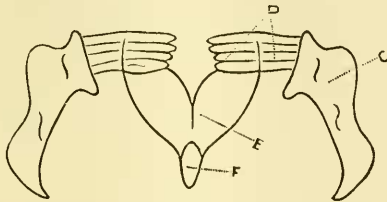
3. *Virgate*.—Mallei rod-like; manubria and fulcrum very long; unci 1- or 2-toothed. (*Notommata*.) A common type.

4. *Forcipate*.—Mallei root-like; unci pointed or evanescent; rami much developed, and used as forceps. (*Diglena*.) Another common type.

5. *Incurvate*.—Rami highly developed into a curved forceps; mallei evanescent; fulcrum stout. (*Asplanchna*.)

6. *Uncinate*.—Unci 2-toothed; manubria evanescent; incus slender. (*Stephanoceros*.)

7. *Ramate*.—Rami subquadratic, each crossed by 2, 3, or 4 teeth; manubria evanescent; fulcrum vestigial. (*Philodina*.)



Trophi of *Brachionus urceolaris*: *c, d* = malleus, *e, f* = incus, *d* = uncus, *c* = manubrium, *e* = rami, *f* = fulcrum.

The following is the order observed in the description of each species: Specific characteristics; length;* colour; general shape; special shape and proportions of body, foot and toes, and head; corona and ciliary wreath; lorica; mouth and gullet; mastax; the other parts of the alimentary canal; musculature; glands; brain and sense-organs; excretory system; reproductive system; movements, habit, and habitat.

Order BDELLOIDA.

Family PHILLODINIDÆ.

Genus *Rotifer*.

Generic characteristics: Eyes two, within the frontal column.

I. *Rotifer macrurus*, Schrank. Plate VIII., figs. i., i.a.

Specific characters: Body white, hyaline at ends, plump and round, merging rather gradually into a very long and tapering foot. Corona large. Spurs small. Frontal column long, cylindrical, truncate. Dorsal antenna of moderate length. Eyes small and round. Teeth two. Differs from English

* Having reason to believe that some of my measurements of length were not quite accurate, I have left this detail out of all my descriptions, awaiting more accurate observation.

variety in—(1) Less plumpness of body; (2) less difference in circumference of body and foot; and (3) greater transparency of body.

No colour. The whole Rotifer is very long and slender. The body proper is less than a third of the length of the whole animal. It shows the plumpness referred to in the British specimens in only a slight degree. It is ornamented with longitudinal flutings of various distinctness, but these are never obtrusive, and have always to be looked for. The foot is very long, slender, and tapering; it consists of six telescopic joints, and is perfectly retractile; the second last joint bears a pair of spurs whose tips are slightly curved. There are three very small toes, which are usually hidden by the spurs of the penultimate joint. The anterior part of the body—the neck and head, if I may so speak—is also long and slender, and very much pointed when fully extended. In this condition the cilia seem to be confined to a small narrow projecting lobe, but when the Rotifer is about to feed the anterior part of the head is completely retracted, and the corona and ciliary wreath spread out into two broad wing-like lobes, making the wreath a sinuous curve right round them, and broken only ventrally opposite the mouth. The mouth leads back by a narrow gullet (in which is a pair of kidney-shaped glands) to the pharynx, which is provided with a pair of ramate trophi. These are shaped like angular coffee-beans, and work upon each other somewhat after the manner of a crayfish's mandibles. There are on each a great number of teeth, in the form of transverse ridges; of these, the two central are by far the most prominent. The two trophi are not quite parallel, but diverge slightly behind. The stomach and intestine lead to the cloaca, which is a rectal, excretory, and reproductive chamber. Rather indistinct bands of muscles work the retractive movements of the foot, but the other muscles could in no case be seen. I did not observe any foot-glands; probably these are of less importance here than usual, because of the mechanical contrivance to secure the toe-hold. The three toes are spread out and placed on the glass, and then the second last joint is pulled down over them, and acts like a ferrule. Obviously the strength and quantity of the cement secreted by the foot-glands need not be so great here as if the whole weight of the animal were to be supported by that alone. I never observed any brain. There are two small red eyes. These lie right in the anterior of the head, and, when this region is protruded, appear to lie quite in the anterior lobe of the corona. They move back very considerably when the corona is expanded in the act of feeding.

In the dorsal side of the "neck," just anterior to the body,

is a dorsal sense-organ; it is of good size, bears a tuft of setæ, and is capable of being erected and depressed.

Rotifer macrurus is viviparous. In examining a specimen I was greatly puzzled by the appearance of two small faint eyes away back in the posterior part of the body, and also by the appearance of two small trophi, which moved slightly while I was watching them. It was not for a long time that I discovered that these appearances were due to the presence of a young Rotifer with the body of its parent. The fœtus was bent round upon itself, and moved freely within the space at its disposal. It turned completely round several times, now having its head directed forwards, and now backwards. It was perhaps half as long as its parent, but much more slender even proportionately.

Movement, typically Bdelloidan. The hold with the foot is taken quite beside the hold with the head, so that the Rotifer travels fully its own length at every loop. I never saw it swim with its ciliary wreath. Its motions were usually lively, a period of creeping being alternated with one of feeding; but at times it would lie wholly retracted into an almost spherical ball. This was the usual attitude taken when death was approaching, but one specimen remained fully extended, and curled its foot up, just as a pig's tail is curled.

Hab. Among Algæ allied to *Spirogyra*. In small pools. Fairly plentiful.

Genus *Callidina*, Ehrenberg.

Generic characters: Eyes absent.

II. *Callidina quadridens*, sp. nov. Plate VIII., figs. ii., ii. a.

Specific characters: Body plump and fluted distinctly, but not closely. Foot very slender. Ciliary wreath projecting forward in two sharp prominences. Teeth, 4.

No colour. Its general shape is long and slender, more so than *R. macrurus*. Its body, however, shows some plumpness as compared with its long head and foot. This latter is very slender, and contains about six telescopic joints. The head is very long, the neck part of it being transversely wrinkled. It is when the anterior part of the head is retracted and the corona expanded that one of the differences between this species and other *Callidinas* is seen. Instead of the corona consisting of two broad lobes, lined by a sinuous wreath of cilia, there are two very narrow projecting lobes, very much narrower than the rest of the body. The longitudinal flutings of the body were very distinctly marked. The mouth is in the ventral centre of the corona. Just within it, on each side of the gullet, are two very distinct bean-shaped glands. These

were observed only once in *R. macrurus*, and then they were very indistinct. Far back, within the contour of the body, are the trophi. These are of the same shape as those of *R. macrurus*, but instead of having only two they have four distinctly marked transverse ridges. The stomach is very capacious. No brain was observed; neither was any kind of sense-organ. The eyes and the dorsal organ are entirely wanting.

Movement, quite like that of other Phillodinidans.

Hab. The horse-trough.

I found only one specimen of this species, and so my description is lamentably incomplete; but there is no doubt that it is a species quite distinct from *C. bidens*, which in general aspect it somewhat resembles.

Order PLOIMA.

Sub-order IL-LORICATA.

Family HYDATINADÆ.

Genus *Hydatina*, Ehrenberg.

Generic characteristics: Body conical, tapering towards the foot. Foot short, and confluent with the trunk. Eye absent, or one cervical.

The distinctive characters of this genus have been enlarged by me, so as to admit a specimen clearly very closely allied to *H. senta*, but possessing a large complex and beautiful eye.

III. *Hydatina monops*, sp. nov. Plate VIII., fig. iii.

Specific characters: Brain large, dark, and very noticeable. It is composed of two large lateral lobes and a smaller posterior one, which is balanced in front by a large red eye.

One of the three largest Rotifers I have seen, equalling *Planoverter gigans* and *Notommata pentophthalma*. There is no definite colour excepting that of the eye, but the usual transparency is absent here, owing partly to its great bulk, and also, no doubt, to a greyish tinge in the organs themselves. The whole animal is pisciform, although it does not taper towards the head. The body is cylindrical, and tapers posteriorly to the thick short foot, which ends in the two small toes. The head is marked off from the body by a deep indented line or neck; it leaves the head about one-third the length of the body, and almost as great in circumference. The head is truncated in front, so that the corona is transverse. The cilia are disposed in a single row, fringing the head of the corona, but breaking opposite the mouth. The cilia at the sides of the head are very large. Several large tufts of cilia

occur on the corona, within the encircling wreath, and just outside an inner wreath. Most of these are so disposed as to very effectually assist the passage of the food to the mouth. Owing to the opaqueness of the surrounding parts, neither mouth, gullet, nor mastax was accurately observed. The mastax is probably very small, and situated about half-way back in the head, for this is where the brain is situated, and it is the only organ of sufficient density to hide so usually obtrusive an organ as the mastax. Behind the mastax the stomach swells out suddenly, and then tapers gradually to the intestine, closely following the outline of the whole animal. The intestine is narrow, and opens into a very small cloaca. There are many strong and obtrusive muscle-bands; those in the head and anterior part of the body pass outwards and backwards, those in the posterior parts more or less parallel with the body-walls. The foot-glands were very noticeable; they are of large size, dark colour, and Indian-club shape; they are quite distinct, and each enters its own toe quite separately. The brain is of quite enormous size. As before hinted, it lies about the centre of the head, and is probably roughly spherical. Looked at from above it is composed of three lobes, two large lateral ones and a small posterior one. It is heavily loaded with a black pigment. In front, corresponding with the small posterior lobe, is inserted a large red eye-spot of rather complicated shape, rather like that of a fancy vase with a knobbed lid on, but clearly seen in the accompanying figure. The bladder for the reception of the excreta is unusually large. It lies to the left and ventral side of the posterior part of the stomach and the intestine, and passes by a narrow tube back to the small cloaca, which opens some distance in front of the foot. Floating all about in the body-cavity were numbers of large eggs; these were already highly segmented in some cases, while in others segmentation had not as yet commenced. The ovary itself, which was very obscure, appeared to lie in the right ventral part of the body-cavity.

Movements and habits I cannot describe, as my only specimen was almost dead when I found it.

Hab. The horse-trough.

Family NOTOMMATADÆ.

Genus *Notommata*, Gosse.

Generic characteristics: Body not annulose, more or less cylindrical, in my species a good deal depressed. Special organs on the head for locomotion; auricles, evertile and protrusible. Brain large, containing opaque chalk masses. Trophi virgate. Eyes (see "Specific characters," below).

IV. *Notommata pentophthalma*, sp. nov. Plate IX., fig. iv.

Specific characters: Body flattened and enclosed in a more or less firm leathery sheath, almost like a lorica, leading to a deceptive similarity between this species and a Euchlanidae. Trophi very large, in middle of the body. Eyes five, one in the anterior of the large dark cervical brain, and two pairs of frontal ones, a large inner and a small outer pair. Tail short. Foot long and prominent. Toes of fair size.

Although this species has five definite eyes, and although no other *Notommata* has more than one, and the *Eosphora* have three, yet I have decided to call this a species of *Notommata*, because of the instability of the number of eyes all through this family, and its consequent worthlessness as a generic characteristic. For instance, Herr Eckstein (Sieb. w. Köll. Zeits., 1883, p. 361) describes in *Notommata aurita*, and in many other Rotifers, specks of crimson pigment frontally situated. These he concludes to be secondary eyes. Again, in *N. naias* Eckstein figures two crimson frontal eye-specks, as he also does in *N. lacinulata* and *Proales felis*. All these Hudson has no hesitation in pronouncing imaginary ("Rotifera," ii., 37). Again, Hudson himself credits *Eosphora aurita* with three eyes, but two of them are denied by Leydig. In this state of affairs the eye-spots cannot be of great value as a distinguishing character, but the discovery of my five-eyed species may make Eckstein's "imaginary" eye-spots worth reconsidering. There can be no doubt about the objectivity of the five eye-spots in my species, for I examined between twenty and thirty specimens, and they were invariably present.

The biggest Rotifer I have seen. No colour except the five red eye-spots, situated as hereinafter described. The body is depressed, but raised up above the head and foot so as to make itself very sharply divided off from them, and also to give itself the appearance of bearing a lorica. The part raised above the foot is the tail. The body is slightly longer than broad, and has an outline consisting of many rough curves, which are constant in position, and show that the integument is hardened in the body region. The foot is of good length, about one-third as long as the body; it projects from under the hardened body-integument, ending in the tail, and is terminated by two small toes. The head is of great size, nearly half the bulk of the body. Near the front of it are two most distinct and highly evertible auricles, cilia beset. These are usually withdrawn, but when protruded are most striking. The whole of the front edge of the head is provided with cilia. The mastax is of great size, and is of the complicated forcipate type. The extreme breadth of the

trophi is noticeable, as is also their peculiar position, right back in nearly the middle of the body. The stomach and intestine are consequently very short, though in one case it appeared as if the stomach swelled out around and ran forward from the mastax. The most important muscles are those which work the mastax. These are of great size and density, and work against each other. Immediately in front of the mastax is the brain; it is of fair size, dark, granular, and opaque; it is semicircular in shape, the diameter of the circle facing forwards. Let into this forward-facing side is a small semicircular eye, concentric with the brain. This is the largest of the eyes, of which there are in all five. The other four are arranged in two pairs very near the front of the head. There is one pair of larger ones, and slightly outwards and forwards from these another pair of much smaller ones. Running forward from the cerebral eye is a double row of bright round spots, about twelve in number, and reaching to the anterior extremity of the body. I cannot guess their use, though it is probably sensory.

The movements of this Rotifer are very slow. The trophi sometimes work actively, opening very widely from side to side. One specimen had retracted its head and foot (an operation not frequently performed), and so appeared quite round. It was filled with small green bodies, probably devoured *Protozoa*.

Hab. The pool.

Five or six specimens were observed during the winter.

Genus **Planoverter**, gen. nov.

Generic characteristics: Of great size, never less than $\frac{1}{80}$ in. Body flattened ventrally, arched dorsally. Corona almost quite prone, with only a slightly upward inclination. Foot very indistinct; toes of fair size. Brain large and dark-coloured. Eye distinct, cervical in position, just in the anterior part of the brain. Tail and auricles wanting.

I have tried to put this specimen into nearly every genus of the *Notommatadae*. The absence of tail and auricles, and the presence of an eye, close to it all genera but *Proales* and *Furcularia*. Now, all the *Proales* hitherto described are small and slight, not large and massive; the ciliated face is not nearly prone, and the brain is invariably clear. As for the *Furcularia*, the body is larviform, not pisciform, compressed, not depressed, and the eye when present is always frontal, not cervical. For these reasons I have placed this specimen in a new genus rather than destroy the distinctness of an old genus by forcing an intruder within its ranks.

V. *Planoverter varicolor*, sp. nov. Plate IX., figs. v., v.a., v.b.

Specific characters: There is no need of these till more species are placed in this new genus. The specific name chosen is given because the various colours are both very obtrusive and unlikely to be found in any species that may be afterwards discovered.

This Rotifer is very prettily coloured. The ovary, which is large and prominent, is of a deep salmon-colour, and the general colour of the body is a light-salmon. The walls of the stomach and intestines are remarkably thick, and are of a bright-yellow colour. The eye is of a brilliant red, and the brain also is tinged with a dark crimson-lake. The stomach is usually filled with a medley of green and yellow and brown food-matter, so that altogether the Rotifer is a very attractive and beautiful object, only the two extremities being without colour. In general shape it is fish-like, its greatest diameter being just anterior to the middle of the body, and tapering to both head and tail. The foot is very small, being chiefly composed of two fair-sized toes. The head is not distinctly marked off from the body. The corona is prone, hardly at all encroaching on the anterior pointed part of the head. The mouth, too, is ventral in the centre of the corona. The gullet passes upwards and backwards. The trophi are very close to the mouth, and they are often extruded therefrom with a remarkably active snapping movement, so that, as Hudson says, it is difficult to believe that you do not hear them close on each other. They are of the forcipate type of trophi, quite similar to those of the *Salpinidae* and *Furcularians*. The stomach is capacious, and fills the middle third of the body. It narrows to the intestine, which opens dorsally just in front of the foot. The walls of both these parts are very thick, yellow in colour, and marked all through with black dots. Possibly these thickened walls may have some physiological significance. I noticed no particular muscles, except the pad surrounding the mastax. The brain is large, depressed, and of oblong shape. It is situated dorsally, just at the junction of what may be called head and body. It is of dark-red colour. Immediately above it is a pit in the integument reaching down to the brain, and leaving only the thickness of the integument between it and the outer air. I have never seen a pit of this kind in any other Rotifer, nor have I ever seen it referred to by any writer on this subject. The eye is of a brilliant-red colour, and is probably just the pigmented anterior face of the brain. This is very frequently the case (*cf.* species III., V., IX. *intra*). The two foot-glands are large, and very prominent. The ovary is large, and of a deep salmon-colour; it lies ventrally, and to

the right side of the animal, and extends through nearly a third of its length.

Planoverter varicolor moves by swimming with its ciliary wreath. Its motions are slow, deliberate, and steady. It never retracts any part of its body, and so affords great facilities for observation. The extrusion of its jaws has been mentioned. This is not an uncommon movement. On one occasion I saw it put out its jaws and seize the end of a piece of Alga, draw it into its mouth, then shift its hold with the trophi, and draw it still further into its mouth, and so on until the piece of Alga stretched unbroken through the whole length of the stomach. Then it was cut off by the ever-active jaws.

Hab. The pool.

Sometimes common, and again not seen for weeks.

Sub-order LORICATA.

FAMILY RATTULIDÆ.

Genus *Mastigocerca*, Ehrenberg.

Generic characteristics: Body fusiform, or irregularly thick. Toe a single style, with accessory stylets at its base. Lorica often furnished with a thin dorsal ridge.

VI. *Mastigocerca flectocaudatus*, sp. nov. Plate VIII., fig. vi.

Specific characters: Body compressed, flat ventrally, arched dorsally, and bent down anteriorly. There is no dorsal ridge. There is a long toe, nearly as long as the body, and a single long substyle, two-thirds as long as the toe. Cervical eye.

No colour except what is caused by highly refractive brown cells in the walls of the stomach. This Rotifer almost invariably swims on its side, and so a side view is by far the most familiar. It is more than three times as long as it is high, and the outline of the body is made up of long curves. The height is probably greater than the breadth, since the usual position in swimming under the cover-glass is on the side. This fact, however, may be explained by the bend in the foot, to be described now. The foot proper is very short and indistinct, but bears a very long style and a shorter substyle, which are bent downwards, and which are incapable of being straightened; moreover, they are set in the foot with a downward inclination, and so always have a general direction at about right angles to the body. This fact would account for the Rotifer not swimming on its ventral surface when under the pressure of the glass. The style is more than two-thirds as long as the body and head of the Rotifer, while the substyle is two-thirds as long as the main style. The foot is often bent so that the tip of the style touches the anterior

part of the body. The head is not distinctly marked off from the rest of the body; it is bent downwards, so that the corona is inclined at an angle of 45° to the plane of the rest of the body. The lorica is very poorly developed, and seems to be more or less pliable. It becomes very soft indeed in the posterior region of the body, but is a little stronger in front, where it forms a small spine on each side. This spine has a much smaller spine just below it. The trophi are of the abnormal forcipate type, and show the want of symmetry characteristic of the family. The left malleus is very long, but the right one is greatly reduced, both in thickness and length. The stomach is surrounded by a number of brown highly refractive bodies, which seem like glands. No brain was observed. The eye is small and round; it is situated above the anterior part of the mastax, and is well back within the body, being very far behind the anterior border of the lorica, which may be said to mark the head from the body. The ovary is small, and is situated posterior to and below the stomach.

This Rotifer's movements are active and restless. It almost always swims on its side—at least, when on a glass slide. Its jaws worked only very rarely. Occasionally it anchored by the tip of its style, held this rigid, and waved itself about from the joint at its foot.

Hab. The pool.

Very common in autumn.

VII. *Mastigocerca rectocaudatus*, sp. nov. Plate IX., figs. vii., vii.a.

Specific characters: Body a long oval, no ridge on lorica. Toe exactly straight, and slightly longer than the body and head. Substyles 4, minute.

No colour except the small red eye. Seen from the side this is a slightly hump-backed Rotifer, with the highest point in the middle; it is also broadest in the middle, and tapers towards the extremities, more so towards the posterior one of course. A symmetrical and rather graceful Rotifer. The foot is short and rather indistinct, but it has an immensely long style, quite as long as the rest of the body. This, as in *M. flectocaudatus*, is always carried at an angle to the general direction of the body. It is surrounded by three or four minute substyles. The head projects forwards and downwards from the body. The cilia must be very small, for I never saw them. The lorica is soft and flexible, though more developed than in *M. flectocaudatus*. There is a small median dorsal cleft, and the hinder border over the foot is concave. The mastax is of the asymmetrical type. The length and strength of the right malleus are very much

reduced, and the right side of the split ramus is also reduced in size. The stomach is plainly marked off from the rest of the alimentary canal, is of large size, and situated rather on the right side of the body. The intestine passes backwards and opens into the cloaca, just anterior to the joint between the foot and the body. No foot-glands were observed, though doubtless they occur, since the Rotifer frequently anchors itself by the extremity of its style. The small red eye-spot is situated well within the anterior border of the lorica. When the head is retracted the trophi move back into the middle of the body, and the eye moves back too, as if it were fastened to the muscles surrounding the mastax. The eye is situated deep down in the body; it is concave on its anterior face, as if it were the posterior border of a transparent globule, which is probably a refractive lens. I was able to make out no more of the internal organs, owing to the unusual opacity of this Rotifer.

The movements of *M. rectocaudatus* are swift and erratic. It seems at times to go into a dormant condition, and does not move for hours. It usually swims on its side, but sometimes its back is presented to the observer. The head is then almost hidden, owing to its downward flexure. The head is often retracted wholly within the body; then the median anterior cleft in the lorica is very clearly seen, and the mastax moves back into the middle of the body. When the Rotifer anchors by its style it waves itself about at the foot-joint, just as *M. flectocaudatus* does.

Hab. The small pool, and another one near it.

FAMILY DINOCHARIDÆ.

Genus *Dinocharis*, Ehrenberg.

Generic characteristics: Lorica vase-shaped, dense, pitted, faceted, and with projecting plates, or armed dorsally with spines. Head retractile within a chitinous cap. Eye single, apparently attached to the mastax. Foot and toes very long, the former bearing spines.

VIII. *Dinocharis inornata*, sp. nov. Plate IX., fig. viii.

Specific characters: Lorica neither faceted nor armed with dorsal spines, but pitted. There are no transverse ridges, but the lorica is smooth. The cap covering the head and the chitinous covering of the foot are not pitted, although the latter bears spines.

The only specimen of this species had about one-third of the way back in its body a large black blotch, which was probably due to some food-matter. There were also some brown cells, probably in connection with the stomach. The general colour of the body was the lightest grey, just re-

deemed from transparency, but the little pits in the lorica make this last easily seen, because of the shadows thrown in its substance. In general shape the body is a very long cylinder. The head, which is about half as long as the body proper, is also cylindrical, and is bluntly pointed. The foot is as long as the body; it is rather slender, and is marked with three telescopic joints. From the last joint spring the two immensely long toes, which themselves are as long as the body, and with the foot proper make up more than half of the entire length of the Rotifer. The cilia in the wreath are restricted in area, but they are very long, distinct, and powerful. The lorica is, next to the foot, the most striking feature of all, as, indeed, might be expected in a Dinocharidan. Where it covers the body it is strong and roughly cylindrical; it ends definitely at both anterior and posterior borders; it is slightly cleft below at the posterior edge; on its upper side, near its posterior end, is a characteristic hump. The lorica is not faceted nor spined, and in this differs from all other species of this family. In place of the facets are little pit-like indentations thickly scattered all over the surface. The head is either covered by an arched retractile chitinous plate or else quite surrounded by a cylindrical shield; I am not sure on this point. Only the posterior two-thirds of the head is thus covered. The proximal part of the foot is also covered with a shield, which is open below, and ends distally and dorsally in two spines, small when compared with those of the rest of the genus. This shield extends nearly half-way down the foot. The head- and foot-shields are not pitted as the lorica is, but have instead some very faint scratch-like markings. The trophi are small, weak, and simple, probably of the forcipate type. I can say nothing definite about the other internal organs, except that there is a small red conical eye, with its apex pointing backwards, just in front of the mastax.

The movements of this Rotifer are rather slow and deliberate. The head and foot, with their chitinous coverings, are frequently retracted. The habit of anchoring by the tips of the toes, and swinging about from side to side, is found here, as in so many other Rotifers.

Hab. The pool.

Rare.

Family SALPINIDÆ.

Genus *Diaschiza*, Gosse.

Generic characteristics: Body compressed, the dorsal half of the trunk enclosed in a carapace (more or less closed below), which is split medially. One eye present, usually cervical. Trophi virgate, not distinguishable from those of *Furcularia*. Toes long, blade-like, furcate.

IX. *Diaschiza taurocephalus*, sp. nov. Plate X., figs. ix., ix.a., ix.b., ix.c., ix.d.

Specific characters: Small, but not so minute as *D. exigua*. The lorica is firm, and apparently closed below. The head is very large. Foot prominent; toes about a quarter the length of the body. The lorica slopes away from its upper posterior edge to about the middle of the ventral line.

No colour, except for the small red globular cervical eye. In some, too, deep rich-brown cells are found surrounding the stomach. This Rotifer is of a short stout build, which is very characteristic. The body is hardly longer than it is high, and the lorica ends abruptly, giving a peculiar hump-backed appearance. The proximal part of the foot is very stout, and is terminated by two long toes. The foot and toes are carried more or less pendent, usually markedly so. The head is, but for the absence of sharp corners, almost an exact square, and is more than half the size of the body; it is marked off from the body by a shallow furrow. The cilia, which are rather short and thick-set, fringe the lower half of the front and the forward half of the bottom of the head. The lorica starts behind the head, and has a well-marked deep dorsal cleft; it is deepest and broadest behind, sloping upwards to non-existence in front. The mastax is of the forcipate type, and is fairly large and strong; it is surrounded by a dense and strong pad of muscle. The stomach and intestine are large, and situated dorsally. As mentioned above, the stomach is sometimes surrounded by large unicellular glands, probably digestive. The food in the stomach is often of a light-yellow colour; I have never seen the green or brown food-matter so commonly found. A few indistinct foot-muscles and the dense mass of muscles surrounding the mastax are all that are easily observed. The foot-glands are apparently large, but are indistinct, and evidently but little used, as I do not remember one of the scores of specimens I observed anchoring itself by its toes. The presumably digestive glands have already been twice mentioned; they are similar to those found in *Metopidia flexocaudatus*, but are not invariably present. The eye is of small size; it is situated near the dorsal surface, just at the junction of neck and body. There is a nick in its median anterior edge. No brain was observed. There is a large reproductive organ in the ventral part of the body.

This Rotifer is of very lively habits. It swims mostly on its side at a great rate across the stage. It is the most plentiful of all Rotifers at the Taieri Beach, and was found in every pool searched.

Var. *tenua*. Figs. ix.c., ix.d.

Varietal characters: Head small, and whole body slender. Foot stout; toes long. Distinct oblique furrow in the lorica, running forwards and downwards from posterior edge.

Colour, none except the deep-red cervical eye, and sometimes the brown cells round the stomach. In general shape this variety is quite unlike the type, so different that I long regarded them as distinct species. It is slender, and has not the least sign of being bull-headed. The foot is stout, and the toes very long. The toes are often spread out so that they lie in one and the same straight line. The head is slender, is not marked off from the body except by the edge of the lorica, and has a downward flexure. The ciliary wreath is much as in the type. The lorica encloses the body more completely than in *taurocephalus* itself. Its posterior edge is distinct, and does not slope away forward, as it does in the type. There is also a very distinct oblique furrow running from the posterior dorsal edge downwards and forwards to near the ventral anterior edge. The mastax is quite like that of the former variety, but is a little stouter. The other parts of the alimentary canal, the muscular bands, glands, excretory and reproductive systems, do not call for remark. The eye is small, but has behind it a small brain of a very light-pink tint.

This variety is on first appearance quite like *D. pæta*. The general shape and the oblique lateral furrow lend themselves to this impression. But the character of the eye is quite different, and this variety is connected by such an unbroken chain of slightly varying individuals with *D. taurocephalus* that there can be no doubt that the difference between them is only varietal. I have described the two extremes of this chain under the name of *taurocephalus* and *tenua*, but all intermediate stages are common.

X.—*Diaschiza semiaperta*, Gosse. Plate X., figs. x. x.a.

Specific characters: Body compressed, highest behind. Lorica with the dorsal cleft closed in front, gaping behind, the ventral edges apparently approximate. Eye frontal. Toes long, slender, recurved.

Colour, none except the small red eye. The shape is high, narrow, and rather clumsy. The body has a hump-backed appearance, the highest point being behind the middle of its length. The body narrows abruptly into a short stump-like one-jointed foot, ending in two extremely long and strong toes, half as long as the body. The head, which is marked off from the body only by its being not enclosed by the lorica, has a downward flexure, and its anterior edge is quite oblique. This oblique surface bears the cilia, and in its centre is a little

hemispherical projection, also cilia-covered, and also bearing the small red eye. This little ciliated and eye-bearing lobe constitutes the chief difference between my variety and that described by English writers, but it is not enough to need the formation of a varietal name. The lorica is vase-shaped and entire, but for its dorsal cleft, which is not complete, occurring only posteriorly, and so exactly corresponding with the English *semiaperta*. The mastax is of the highly developed forcipate variety, though I can hardly vouch for the details of my figure. It is situated far forward, completely within the head. The other parts of the alimentary canal were quite obscure, the only thing noticed being that they occupied the usual dorsal position. No particular muscles, glands, or brain were noticed. The peculiar position of the eye, on a lobe apparently its own, and further forward than in any other variety, has already been noticed. There is a large female reproductive gland, situated ventrally.

The movements of this Rotifer were of the briskest order; it never seemed to rest. During fifteen minutes I saw it trying with cilia and trophi to swallow one of its little cousins—*D. taurocephalus*, var. *tenua*. The head of the intended victim was well within its captor's maw, but there it stayed, and *semiaperta* at last gave it up, sailing away for fresh fields, and leaving *taurocephalus (tenua)* in quite a disabled condition. This is the only case of cannibalism I noticed.

Hab. Spirogyra, in the small pool, and I think also in another, half a mile away over a hill.

Genus **Postclausa**, nov. gen.

Generic characteristics: Body greatly compressed. One cervical eye. Head and foot very flexible, and protrusible. Lorica open in front, but completely closed behind and below, with the exception of a small orifice for the foot. No spines, but knobs in ornamentation. Trophi virgate, but very slender.

XI. *Postclausa minuta*, sp. nov. Plate X., figs. xi., xi.a.

Specific characters: Minute; long and low in general shape. There are four ornamental knobs on the lorica—two at the orifice for the head and two at that for the foot. Dorsal cleft very narrow and deep. Eye and brain conjoined in the cervical region.

The smallest Rotifer I have seen, being considerably less than *Diaschiza taurocephalus*. No colour, except that due to food and to the small red eye. The general shape of the Rotifer is that of a very fat sausage, about twice as long as thick, rounded at both ends, and quite wanting in angles. The body proper comprises almost the whole of this outline, since the foot is small and pendent. It projects not from the

posterior of the body, but from its ventral side, about two-thirds of the way back. There is a special little knob-guarded aperture from which it protrudes, and through which it is often wholly retracted. It consists of only one joint, protruding only a short distance beyond the knobs spoken of above, and ending in two toes a little longer than the foot itself. The head is small, and not well defined from the rest of the body. It is rounded off in front, and is, like the foot, entirely retractile within the lorica. Cilia fringe all its anterior face; they are of medium size and rather slow motion. The lorica is, of course, peculiar. Instead of spines it goes in for knobs. Two blunt ones project above and below the head, and two more smaller and better-defined ones project in front of and behind the aperture for the foot. The anterior edge is well defined, and the whole of the rest of the body is encased in this hyaline shell, except for the small ventral foot-hole. The lorica seems fairly dense, especially behind, where it completely closes in the posterior of the animal. The dorsal cleft is very distinct when carefully looked for; it is exceptionally deep, narrow, and well defined. The mastax is of the forcipate type common to the Salpinidæans and Notommatadæans. It is, however, very small and slender, and so rather difficult to draw. The pincer-like portions of the rami are very long, and protrude in front of the rest of the mastax. The alimentary canal is of large proportions, and passes along the dorsal part of the body, then round the posterior part, and for a short distance along the ventral side, till it reaches the posterior junction of the foot and body. It was filled with rounded yellowish masses of food-matter, and was considerably distended. The brain is of fair size, and is situated near the dorsal surface, about one-third of the way back from the head. Its anterior veneer is coloured with a red pigment answering to the eye, which, as far as position goes, bears the same relation to the brain as the peel of half an orange bears to the orange. I saw nothing of the other internal organs.

Movement, fairly brisk, though not so brisk as to make the drawing difficult. Like other compressed Rotifers, it swims on its side almost exclusively while under the cover-glass, though I suppose there is little doubt that it swims upright when in its natural conditions. The head and foot are retracted as wholes with fair frequency.

Hab. The pool.

Rather rare.

XII. *Postclausa circularis*, sp. nov. Plate X., figs. xii., xii.a.

Specific characters: Body greatly flattened from side to side. Outline of body from the side almost circular. Lorica not very firm; front edge imperceptibly dwindling away. Only

one instead of four knobs, and that one posterior to the orifice for the foot. Stomach enormous.

Colour: Although almost colourless in itself, this Rotifer is a very striking object on the stage, owing to the great mass of dark-brown and dark-yellow food-matter it contains. There is a rather small red eye cervically, and in some specimens large pink-tinted eggs. In general shape this Rotifer is almost round—indeed, its dorsal and posterior edges form a segment of a perfect circle, and when the head and foot are retracted the circle is almost complete. It is, however, evidently much compressed, so that its roundness is that of a plate, not of a ball, for no specimen that I observed ever moved off its side. The foot is pendent from a small orifice in the lorica, about a quarter of the way in front of the posterior end of the ventral side. It is rather long, being able with its toes to touch the corona; but its chief characteristics are its worm-like flexibility and its hyaline transparency. It is nearly always protruded in a forward direction. The head is not marked off distinctly from the rest of the body except by its protrusion beyond the general outline of the rough circle, and by the line where its invagination ends. It is not covered by the lorica; it is very flexible, and is almost constantly changing shape. It has three indistinct lobes, or more probably a raised central portion. It is in the slight depression at the junction of this central portion with the general surface of the head that invagination commences. The head is not retracted as a whole, but the extremity is pulled in first, just as the tentacle of a snail is, and the anterior part of the head can be seen travelling backwards into the centre of the body, just as the eye of a snail can be seen travelling down its tentacle. The ciliary wreath is restricted in area, covering only the raised central part of the corona, and having a circle of longer cilia in the above-mentioned depression, at which the invagination of the head commences. The lorica is not as much developed as that of *P. minuta*. In no part has it the appearance of such solidity, and in front, instead of having a well-defined edge with two ornamental knobs, it merely dwindles away, gradually merging into the unchitinized covering of the head. One of the knobs, too—that guarding the orifice of the foot—is missing, so that on the whole this may be taken as a less specialised lorica than that of its generic companion. I observed no dorsal cleft in the lorica, so that I have missed the family characteristic; but *P. minuta* is so distinctly a Salpinidæan, and this is so distinctly a close ally of *minuta*, that I have no hesitation in calling this too a Salpinidæan. The mouth is situated at the ventral point of the circular depression. The gullet is very small yet distinct, and leads back to the small, simple, and very slender mastax. After the mastax

comes a perfectly enormous stomach, filling up nearly all the great circular body. It is filled with a great quantity of food-matter rolled up in little balls (fig. xii.a.), and varying in colour from dark-brown to dark-yellow. The specimen figured bears three eggs, but, in the other I saw, the whole body-space was filled with food. The intestine rather indistinctly leads round from the posterior part of the body to the ventral side, and so to the junction of the foot and the body. The musculature is faint, but some distinct strands may be seen in the flexible foot. No glands of any kind were observed. The only sense-organ is the eye. It is placed cervically, near the dorsal part of the body, and is wedge- or pyramid-shaped, with the apex pointing downward. It is of the usual red colour. No brain could be observed. In one specimen three large pink-tinted eggs, already segmented, were situated over the orifice of the foot.

The two specimens that I found were both very sluggish; I rather fancy one died while I was observing it, while the other never moved out of its place; so that of the movements of this Salpinidæan I can say almost nothing. It extended and retracted its head and foot with great frequency, and sometimes waved its cilia vigorously, sometimes held them still, but that is all I can say.

Both specimens occurred on the same slide, and were secured from the small pool.

Family COLURIDÆ.

Genus *Colurus*, Ehrenberg.

Generic characteristics: Body subglobose, more or less compressed. Lorica of two lateral plates, open in front, united on the back, gaping behind and (in general) wholly so up the belly. Frontal hood in form of a hook, not retractile. Foot permanently extruded, of distinct joints, terminated by two furcate toes.

XIII. *Colurus gracilis*, sp. nov. Plate XI., figs. xiii., xiii.a., xiii.b.

Specific characters: Lorica in dorsal aspect most gracefully oval. A very slight anterior and posterior dorsal fissure. Ventrally the two lorical plates approach each other in the middle of the ventral line, and then sweep away from each other both posteriorly and anteriorly in an easy graceful curve. Oval in lateral aspect. Foot of three joints, half as long as body, pendent from a point a quarter of the way from posterior body. No eyes.

Absolutely no colour. As this, with the other *Coluridæ*, is compressed, it usually swims on its side, and then presents an oval outline, the greatest breadth of the oval being just

behind the middle. Seen from above the shape is that of a narrow and long, but perfectly true, ovoid, tapering behind but broader in front. The foot consists of three telescopic joints; the last of these has a slightly expanded distal extremity, to which the two small triangular toes are attached. The two toes are usually held close to each other. The length of the foot is such that when flexed its toes reach the base of the head. It is pendent from the body about three-quarters or five-sixths of the way back in the body. The head is of fair size, and is very freely movable on the rest of the body, but is usually retracted. It has a chitinous hood, narrow and hook-shaped. Its anterior edge appears not as a segment of a sphere, but somewhat indented in front, as in *C. bicuspidatus*. The outline of the front of the head is irregular, there being a kind of bay taken out of it above. The ciliated area is small, and confined to the lower half of the front of the head. The lorica is completely closed above, but has a very small median posterior and anterior slit. It is quite open below. The two valves approach each other in the middle of the ventral line, and then sweep away in both directions, but more rapidly anteriorly than posteriorly. There is some slight appearance of longitudinal ridging of the lorica. The mastax is small, of the malleate type, and situated about the junction of the head and body. The alimentary canal passes along the dorsal central region of the body to the origin of the foot. No brain or eye was visible. Two small bright spots, referred to by Ehrenberg as inexplicable, and by Gosse as vesicles of air or oil, lie one on each side of the centre of the middle line, near the dorsal side. Under these lie the large paired reproductive organs.

The movements are active but steady. The frontal hook moves slightly, and as the point of vision is altered its anterior edge appears either straight, curved convexly, or indented in the middle, this last probably being the true shape. There are fairly long periods of foot-anchored rest.

Hab. In the small pool.

Rare.

Genus *Metopidia*, Ehrenberg.

Generic characteristics: Lorica usually depressed, entire, with an opening at each end for the emission of the head and foot. Frontal hood in form of a hook. Foot permanently extruded, of distinct joints, terminated by two furcate toes.

XIV. *Metopidia acuminata*, Ehrenberg. Plate XI., fig. xiv.

Specific characters: Lorica ovate, ending behind in an acute point, occipitally deeply notched between projecting spines, the edges very thin.

To avoid making too many species I have put this under the same name as the Rotifer already described by Ehrenberg. One of the chief differences between this New Zealand variety and that of England is its much greater size, being probably twice the size of the already described *acuminata*. The other varietal differences noted are—(1) My variety has no dorsal cephalic lorical cleft; and (2) the trophi here are well forward in the head, and not back in the neck. Sinking these three differences, the two agree perfectly. Colour, absolutely none. It is greatly depressed, and of a graceful outline. Rather narrowed in front, it swells out till it reaches its greatest breadth half-way back. Then, narrowing rather rapidly, it ends in the sharp median spine of the lorica. The foot is rather short, and composed of three telescopic joints, and ends in two small narrow toes. It trails behind the body when the animal is in motion. The head protrudes, extending forward the regular shape of the body. The cilia fringe the anterior border of the head, and are rather small and numerous. The lorica partakes of the graceful shape of the body. There are two blunt lateral spines in front, and the sharp median one behind. It is, of course, arched dorsally; flat and incomplete behind ventrally. An arched retractile chitinous plate covers the head. The mouth is on the centre of the anterior ventral edge of the head. The trophi, which are situated well forward in the head, and are of rather small size, belong to the malleate type. The muscles working the trophi are strong, especially the band joining the opposite manubria. The lateral muscles of the foot are strongly developed. There is no brain nor sense-organ of any kind, as far as I could see. A small bright spot occurs on the left edge, near the dorsal side, and about one-third the way back from the head; this is probably one of the "oil globules" found in *Colurus*.

The movements of this Rotifer are rather peculiar. It floats slowly forward to a piece of Alga, then flecks its foot sharply sideways, and so springs backwards. Its foot slowly swings back to its first position, while the Rotifer is again progressing by means of its cilia. It always swims on its ventral surface, owing to its depressed shape. I saw only two specimens of this species, close together on the same slide. They came from the same prolific pool.

XV. *Metopidia solidus*, Gosse. Plate XI., figs. xv., xv.a., xv.b., xv.c., xv.d.

Specific characters: Lorica nearly circular, depressed. Ventral plate commensurate with the dorsal, but more deeply excavate in the posterior notch. The dorsal plate has a sub-marginal line of corrugation.

Colour: A pair of cephalic small red eyes. This is, of course, a species greatly depressed—very greatly depressed. The body, viewed from the dorsal side, is almost circular, the head and foot protruding and breaking the outline. The foot has three distinct telescopic joints, ending in two slender toes of medium length. The head is of a regular rounded shape, with two lateral projections, in which the eyes are lodged. The cilia are arranged round the front of the head, are mostly small, but there is a little clump of larger ones in the centre. The lorica partakes of the almost globular shape of the body; it embraces the sides of the head with two rather sharp lateral spines, then swells out and sweeps round as if its posterior end were to be a segment of a circle, but a narrow and rather deep bay just over the foot prevents this, and forms two obtuse points at its starting-place. The corresponding bay on the ventral side is of the same width, but is much deeper, to allow the foot to hang down. The difference in the depth of the two indentations is much greater in my specimens than in those drawn by Gosse. The lower valve of the lorica—if I may say “valve”—is flat, but the dorsal one is arched, most sharply in the middle, and flattened out at the edges. Close to the edge and all round are marks like those of the milling of a coin. This feature suggested the name to Gosse, who first described the species; but I found it an exceedingly variable characteristic, sometimes quite undiscernible. There is an arched retractile chitinous plate covering the head. The mastax is situated just within the anterior edge of the lorica, is of the malleate type, with three or four teeth in the uncus. The alimentary canal holds a winding course down the middle of the body, and enters the cloaca just at the base of the foot. The foot-muscles are feebly developed, as the foot is neither waved about, retracted as a whole, nor joint by joint. A brain of fair size is situated above the anterior part of the mastax. Two small red eyes are situated in protruding lobes on sides of the head. The reproductive organs are of great size, they and large eggs filling up all the body-space not occupied by the alimentary organs.

The movements of this Rotifer are steady and deliberate.

Hab. The alga-covered pool.

Var. *latusinus*. Fig. xv.d.

In this variety the anterior and especially the posterior emarginations are very broad, and the ventral one is hardly greater than the dorsal. The points made by the bays in the lorica are not obtuse, but sharp and gracefully bent upwards and outwards.

Family ANURÆADÆ.

Genus **Notholca**, Gosse.

Generic characteristics: Lorica ovate, truncate, and six-spined in front, sometimes produced behind, of two spoon-like plates united laterally; no hind spines. Dorsal surface marked longitudinally with alternate ridges and furrows; expelled egg not usually carried. Lacustrine and marine.

XVI. *Notholca regularis*,* sp. nov. Plate XI., figs. xvi., xvi.a.

Specific characters: Body oval in outline, with a slight contraction in the middle. The six spines on the occipital edge are nearly all exactly the same size. Ventral plate slightly shorter than the dorsal one. An open cleft between the two posteriorly, but they are commensurate occipitally and laterally. Semi-marine.

Colour: There is a round red eye of medium size, and a very large russet salmon-coloured egg of more than half the bulk of the whole body. The body is depressed, and looked at from above has the appearance of a tolerably regular oval, slightly broader behind. There is no foot. The head is not sharply marked off from the body, but is seen to have a definite size by its retractability. It continues forwards the regular shape of the body. The ciliary wreath is single, and fringes the corona, on which there are also three prominent setigerous prominences. The centre of these is the narrowest, and slightly the longest. The lorica is entire, depressed, flat below, arched dorsally. The upper and lower valves are not exactly applied posteriorly, but leave an open cleft. Its anterior margin is ornamented with six sharp and graceful spines; four of these spines are dorsal and two lateral. The median cleft between the two inner spines is the deepest. The whole lorica is of hyaline transparency. The mouth is terminal and central. The mastax is of the malleate type, situated at about the junction of the head and body. The alimentary canal passes round to the left side of the body, then bends centralwards again, and ends in the posteriorly terminal cloaca. No especial muscles were noticed, except some ceaselessly active ones in the walls of the rectum, which is always undergoing opening and closing movements like those of a heart. The rectum is attached by muscular bands to the lorica. The only sense-organ is the round eye set in about the centre of the head. No definite parts of the excretory system were noticed, except the contractile vesicle in

* Evidently closely akin to *N. jugosa* (Gosse, Jour. Roy. Mic. Soc., 1887, p. 1), but differing somewhat in general shape, ciliated prominences, position of eye, and absence of furrows.

connection with the rectum, in which the pumping movements are so clearly seen. There was one very large coloured egg, situated definitely to the right and rather to the posterior of the body.

The movements of this Rotifer were always brisk. The whirlpool made by its cilia was noticeably large, strong, and far-reaching. The head was retracted completely, though only occasionally, and then the anterior spines of the lorica were seen to perfection.

I found also another Brachionidæan of very much smaller size, but rather similar appearance. It had no egg. I did not get a complete drawing or description of it, and so have just mentioned it.

Both these Brachionidæans came from a ditch which was in communication with the tidal Akatore Creek. The water was sufficiently saline to taste so, and for the salt to crystallize on the slide.

REFERENCES TO FORMER DESCRIPTIONS OF SPECIES.

- I. *Rotifer macrurus*, Ehrenberg, Die Infus., p. 490; Pritchard, "Infusoria," p. 704; Gosse, "Rotifera," p. 107, vol. i.
 X. *Diaschiza semiaperta*, Gosse, "Rotifera," p. 80, vol. ii.
 XIV. *Metopidia acuminata*, Ehrenberg, Die Infus., p. 477; Gosse, "Rotifera," p. 107, vol. ii.
 XV. *Metopidia solidus*, Gosse, "Rotifera," p. 106, vol. ii.

EXPLANATION OF PLATES VIII.—XI.

PLATE VIII.

- Fig. i. *Rotifer macrurus*, in act of feeding.
 Fig. i.a. " " side view, in act of creeping.
 Fig. ii. *Callidina quadridens*.
 Fig. ii.a. " " the trophi.
 Fig. iii. *Hydatina monops*.
 Fig. vi. *Mastigocerca flectocaudatus*.

PLATE IX.

- Fig. iv. *Notommata pentophthalma*.
 Fig. v. *Planoverter varicolor*, side view.
 Fig. v.a. " " dorsal view.
 Fig. v.b. " " the trophi.
 Fig. vii. *Mastigocerca rectocaudatus*, dorsal view.
 Fig. vii.a. " " side view.
 Fig. viii. *Dinocharis inornata*.

PLATE X.

- Fig. ix. *Diaschiza taurocephalus*.
 Fig. ix.a. " " the eye, from above.
 Fig. ix.b. " " the trophi.
 Fig. ix.c. " " var. *tenua*.
 Fig. ix.d. " " trophi of *tenua*.

PLATE X.—continued.

- Fig. x. *Diaschiza semiaperta*.
 Fig. x.a. " the trophi.
 Fig. xi. *Postclausa minuta*.
 Fig. xi.a. " the trophi.
 Fig. xii. *Postclausa circularis*.
 Fig. xii.a. " portion of the food-mass in the stomach
 (enlarged).

PLATE XI.

- Fig. xiii. *Colurus gracilis*.
 Fig. xiii.a. " dorsal view.
 Fig. xiii.b. " ventral view of lorica.
 Fig. xiv. *Metopidia acuminata*.
 Fig. xv. *Metopidia solidus*.
 Fig. xv.a. " side view.
 Fig. xv.b. " view of ventral half of lorica.
 Fig. xv.c. " the trophi.
 Fig. xv.d. " lorica of var. *latusinus*.
 Fig. xvi. *Notholca regularis*.
 Fig. xvi.a. " side view of posterior part of lorica.

ART. XV.—*A List of Marine Shells found at Whangarei Heads.*

By CHARLES COOPER.

[Read before the Auckland Institute, 10th October, 1898.]

THE district of Whangarei Heads is on the east coast of Auckland Province, and about seventy miles north of Auckland. For the purposes of this paper the northern boundary of the district is a line from Marsden Point to the Kauri Mountain, and includes the entrance to Whangarei Harbour, the coast-line to Bream Head, and from thence to the Kauri Mountain. The country is mainly composed of volcanic breccia, with dykes of diorite with some slate. There is a good variety in the shore; mudflats, sandy beaches, and heavy boulders make it a favourable place for marine life. Inside the Heads the water is more or less smooth, while outside the beach is exposed to the full force of the waves of the open ocean.

The shells have been collected at various times by shore-hunting and dredging by myself and friends, and I have to thank Mr. H. Suter for his assistance in naming some of them.

Fam. LEPIDOPLEURIDÆ.

Lepidopleurus inquinatus, *Reeve*.